According to the present invention, the cylindrical roller portion is prepared by press molding a mixture of hydraulic composition comprising a hydraulic powder and a non-hydraulic powder and a workability improver and then curing and hardening the molded body. The roller portion can be machined at a high machining precision with high machinability (workability), which gives rise to shape/dimension stability with excellent paper feed accuracy.

More specifically, the hydraulic composition is suitable for press molding, and the incorporation of the workability improver into the hydraulic composition improves cutting/grinding workability of the roller portion due to improved toughness thereof and enables the roller portion to be prevented from cracking and chipping. The workability of the molded body obtained from the hydraulic composition, which has been difficult to use with mechanical workings such as cutting, grinding, etc., can be improved to the same level as that of the metallic materials (See pages 20-21 of the present specification). The press molded body can be cut with a lathe, ground with a cylindrical grinder, or otherwise machined like metallic materials. Thus, the roller portion can be finely worked or machined at a precision on the order of a few μm.

The above is clear from Table 1, wherein Examples 1 to 3 show excellent moldability, mold releasability (removability), grindabilty and grinding accuracy, whereas the Comparative Examples do not satisfy these characteristics. From Table 2,

showing the working speed and the grinding accuracy for three products including the invention product, it is clear that the invention product exhibits excellent working speed with the same grinding accuracy as that of SUM free cutting steel and an alumina sintered body.

As is understood from the above, the hydraulic composition including the workability improver in the present invention provide the paper feed roller with excellent characteristics, unavailable using conventional hydraulic composition containing no workability improver.

Please note that applicants have amended each of independent claims 1, 8, 10, 12, and 18.

The Office Action states that KELLER teaches a rotary shaft 8, and a cylindrical roller portion 10 integrated with an outer periphery of the rotary shaft 8, wherein the cylindrical roller comprises a mixture of a hydraulic composition. This rejection may be based on a mistaken construction of "hydraulic composition".

The platen for printing in KELLER comprises a resilient tubular sleeve constructed of a material such as rubber, a shaft means, and a molded-in-place core disposed and filling the space between the shaft means and the sleeve and constructed of a moldable plastic material. Therefore, it is respectfully suggested that the claimed invention is patentability distinguished from KELLER.

The Office Action rejects claims 1 and 2 under 35 USC §102(b) as anticipated by TAKEI et al. (EP 0 734 873 A2). Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The Office Action states that TAKEI et al. teach a rotary shaft 2, and a cylindrical roller portion 3 integrated with an outer periphery of the rotary shaft 2, wherein the cylindrical roller comprises a mixture of a hydraulic composition.

TAKEI et al. actually teach a roller for an image forming apparatus, comprising a shaft, a core body formed of a ceramic material solidified around the outer periphery of the rotary shaft, and a surface layer composes of a rubber around the core body (See claim 1, etc.) The core body is made of a fluid material that can be solidified, such as cement or ceramic sintered at a high temperature ("ceramic"). See column 2, lines 22-25. Fig. 8 shows a mold for forming the platen rollers of TAKEI et al. In this embodiment, the ceramic is injected into the space formed by the coupled half-split bodies 41 through the ceramic injecting holes 47 formed in the end walls, and the core body is solidified around the circumferential surface of the roller shaft. See column 3, lines 44-54.

In TAKEI et al., the ceramic is a material suitable for casting or pouring ("injection" and "injecting" are seemingly incorrect translations) in case of "solidification", but no specific material seems to be recited. Further, it seems in

TAKEI et al., that the core body is not worked as in the present invention, and instead the core body is cored with the smooth surface layer.

In conclusion, the claimed invention is believed not to be anticipated by or rendered obvious over TAKEI et al.

The Office Action rejects claims 1 and 2 under 35 USC §102(b) by MINO et al. (DE 3617316A1). Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The Office Action states that MINO et al. teach a paper feed roller comprising a rotary shaft, and a cylindrical roller portion integrated with an outer periphery of the rotary shaft, wherein the cylindrical roller comprises a mixture of a hydraulic composition.

MINO et al. relate to a high strength mortar/concrete roll in a water-squeezing press for making pulps and papers, which roll has a compression strength of 600 kg/cm^2 or more and comprises a mortar/concrete hardened body and crushed stone particles contained in the hardened body and having strength equal to or more than that of the hardened body.

Therefore, MINO et al.'s roll is quite different from the claimed paper feed roller to be used in the fine machine such as the printer, facsimile, or the like, of the present invention. MINO et al. teach the addition of a water-reducing agent and use of super fine powder having the average particle diameter of around 0.1μm. The composition of the roller in MINO et al. is

quite different from the hydraulic composition recited in the present claims.

Therefore, MINO et al. is believed not to anticipate or render obvious the claimed invention.

The Office Action rejects claims 3-7 under 35 USC §103(a) over MINO et al. in view of FUCHS et al. 5,257,965. Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The Office Action states that MINO et al. teach the invention cited above with the exception of the cylindrical molded bodies in a direction of the rotary shaft, and that FUCHS et al. teach a cylindrical roller portion 1 being formed by connecting a plurality of cylindrical molded bodies 4 in a direction of the rotary shaft 3.

The significant differences between the apparatus of MINO et al. and the claimed invention are discussed above in connection with the anticipation rejection based on such reference. For at least this reason, the combination of MINO et al. with FUCHS et al. is believed not to render the claimed invention obvious.

Applicants note that there are great differences between the claimed invention and the device of FUCHS et al. in terms of the application and technical field. That is, FUCHS et al. is directed to a roller for the pressure treatment of webs such as papers, pulps, etc., whereas the claimed invention is directed to the paper feed rollers for use in printers, facsimile

machines and copying machines, requiring papers to be accurately conveyed. The claimed paper feed roller is required to feed papers at high accuracy in the printer, facsimile or the copier, so that it needs to exhibit high deviating precision, anti-vibration and light weight different from the water-squeezing rolls in MINO et al. and FUCHS et al.

Even one of skill in the art could not possibly conceive the claimed invention based on MINO et al. and FUCHS et al., because the water-squeezing roller significantly differs from the platen roller in terms of the field of use and the characteristics required.

The Office Action rejects claims 8-9 under 35 USC §103(a) over MINO et al. in view of FUCHS et al. and REBRES et al. 5,267,008'. Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The Office Action states that MINO et al. teach a method for producing a paper-feed roller, comprising the steps of forming a cylindrical molded body of a hydraulic composition, releasing, curing and hardening the molded body, and inserting a rotary shaft through the hole of the molded body. MINO et al. are construed as teaching the recited invention with the exception of the step of forming a plurality of cylindrical bodies having a hole at a central portion by press molding, and connecting adjacent cylindrical molded bodies, and thereby integrally forming a cylindrical roller portion around an outer peripheral surface of the rotary shaft. FUCHS et al. are offered

for teaching forming a plurality of cylindrical bodies 4 having a hole at a central portion and connecting adjacent cylindrical molded bodies 4, and thereby integrally forming a cylindrical roller portion 1 around an outer peripheral surface of the rotary shaft 3. REBRES et al. are offered as teaching press molding individual cylindrical bodies.

Regardless of the teaching of REBRES et al. in connection with the features recited in claims 8 and 9, the combination of MINO et al. and FUCHS et al. fail to teach or suggest the features recited in claim 8, at least in connection with the composition of the recited mixture.

The Office Action rejects claims 12-14 under 35 USC §103(a) MINO et al. in view of KELLER. Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The Office Action states that MINO et al. teach the features of the recited invention with the exception of press molding and arranging two rotary shaft portions to be concentric with an outer peripheral surface of the cylindrical roller portion, and that FUCHS et al. teach a cylindrical roller portion 1 being formed by connecting a plurality of cylindrical molded bodies 4 in a direction of the rotary shaft 3.

Since the primary MINO et al. reference fails to disclose a number of the features of the claimed invention, as addressed above, the combination of MINO et al. with FUCHS et al. similarly fails to render the claimed invention obvious.

The Office Action rejects claims 15-17 under 35 USC §103(a) over MINO et al. in view of KELLER and FUCHS et al. Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The KELLER reference fails to overcome the shortcomings of MINO et al. and FUCH et al., and therefore the combination fails to render obvious the invention recited in the rejected claims, including those features recited in amended independent claim 12, from which the rejected claims depend.

The Office Action rejects claims 10-11 over under 35 USC §103(a) REBRES et al. 5,267,008 in view of YAMAMOTO et al. 5,649,362. Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The Office Action states that REBRES et al. teach forming a plurality of molded bodies 81, 82, each having a hole at a central portion by press molding a composition of a hydraulic composition.

Applicants respectfully suggest that REBRES et al. relate to a friction feeder system comprising sheet support means, and composite feed roll means including portions of silicone and isoprene material (claim 1, etc.)

Therefore, the roller means in REBRES et al. is quite different from the roller portion in the claimed invention composed of the specified hydraulic composition.

On the other hand, YAMAMOTO et al. relate to a method for producing a permanent magnet member composed of an integral

sintered body including a cylindrical center portion and shaft portions formed at opposite ends of the cylindrical center portion.

The Office Action refers specifically to column 5, lines 55-59 of YAMAMOTO et al. This passage, however, must be considered in context. It is readily understandable from just the above sentences that the green body is obtained from ferrite particles and the binder. Further, "sintering" is completely different from "curing and hardening" in the claimed invention.

Therefore, even the combination of REBRES et al. with YAMAMOTO et al. fails to teach or suggest the claimed invention.

The Office Action rejects claims 18-21 and 23 under 35 USC §103 over REBRES et al. in view of YAMAMOTO et al. and TAKEI (EP 0 734 873 A2). Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

As pointed out above, the combination of REBRES et al. with YAMAMOTO et al. fails to render claims 10 and 11 obvious. The further addition of TAKEI to this combination fails to overcome their shortcomings. Rather, the preferred combination of these three references must be fairly construed as being completely incompatible with one another.

The Office Action rejects claim 22 under 35 USC §103(a) over REBRES et al. in view of YAMAMOTO and TAKEI and FUCHS et al. Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The Office Action states that the combination of REBRES et al., YAMAMOTO, and TAKEI teach the invention cited above with the exception of having a connecting core rod. However, as discussed above, the combination of REBRES et al., YAMAMOTO, and TAKEI itself is inherently inconsistent.

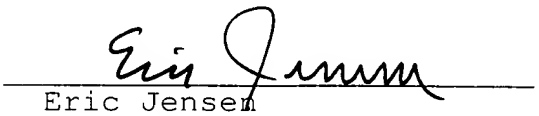
In light of the amendments described above and the arguments offered in support thereof, Applicant believes that the present application is in condition for allowance and an early indication of the same is respectfully requested.

If the Examiner has any questions or requires further clarification of any of the above points, the Examiner may contact the undersigned Attorney so that this application may continue to be expeditiously advanced.

Attached hereto is a marked-up version of the changes made to the claims. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Respectfully submitted,

YOUNG & THOMPSON

By 

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claim 1 was amended as follows:

--1. (Twice amended) A paper feed roller comprising:

a rotary shaft, and

a cylindrical roller portion prepared by press molding a mixture of hydraulic composition comprising a hydraulic powder and a non-hydraulic powder and a workability improver and then curing and hardening the molded body, said cylindrical roller portion being integrated with an outer periphery of the rotary shaft,

wherein the cylindrical roller comprises a mixture of a hydraulic composition.--

Claim 8 was amended as follows:

--8. (Twice amended) A method for producing a paper feed roller, comprising the steps of:

forming a plurality of cylindrical molded bodies by press molding a mixture of a hydraulic composition comprising a hydraulic powder and a non-hydraulic powder and a workability improver, each of the cylindrical molded bodies having a hole at a central portion through molding the hydraulic composition,

releasing, curing and hardening the molded bodies,

inserting a rotary shaft [though] through the holes of the plurality of cylindrical molded bodies, and

connecting adjacent said cylindrical molded bodies, and thereby integrally forming a cylindrical roller portion around an outer peripheral surface of the rotary shaft.--

Claim 10 was amended as follows:

--10. (Twice amended) A method for producing a paper feed roller, comprising the steps of:

forming a plurality of cylindrical green press molded bodies each having a hole at a central portion by press molding a mixture of a hydraulic composition comprising a hydraulic powder and a non-hydraulic powder and a workability improver,

releasing the green press molded bodies,

inserting a rotary shaft [though] through the holes of the plurality of the cylindrical green press molded bodies,

connecting adjacent said cylindrical green press molded bodies, and

forming a cylindrical shaped body through curing and hardening the connected cylindrical green press molded bodies, so as to integrally form a cylindrical roller portion around an outer peripheral surface of the rotary shaft.--

Claim 12 was amended as follows:

--12. (Twice amended) A method for producing a paper feed roller, comprising the steps of:

forming a cylindrical roller portion from a cylindrical press molded body shaped through press molding a mixture of a

hydraulic composition comprising a hydraulic powder and a non-hydraulic powder and a workability improver,

releasing, curing and hardening the press molded body,

arranging two rotary shaft portions to be concentric with an outer peripheral surface of the cylindrical roller portion, and

attaching the two rotary shaft portions to opposite end portions of the cylindrical roller portion, the two rotary shaft portions being aligned with each other, so as to form a rotary shaft by the two rotary shaft portions.--

Claim 15 was amended as follows:

15. (Twice amended) The paper feed roller-producing method set forth in claim 12, wherein a plurality of cylindrical press molded bodies are formed by molding the hydraulic composition, and releasing, curing and hardening the press molded body, and the cylindrical roller portion is formed by connecting the cylindrical press molded bodies together.-

Claim 18 was amended as follows:

--18. (Twice amended) A method for producing a paper feed roller, comprising the steps of:

press molding a mixture of a hydraulic composition comprising a hydraulic powder and a non-hydraulic powder and a workability improver to produce cylindrical green press molded bodies,

releasing the cylindrical green press molded bodies,

forming a cylindrical roller portion from the cylindrical green press molded bodies,

arranging two rotary shaft portions to be concentric with an outer peripheral surface of the cylindrical roller portion, and

attaching the two rotary shaft portions to opposite end portions of the cylindrical roller portion, the two rotary shaft portions being aligned with each other, so as to form a rotary shaft by the two rotary shaft portions, and

curing and hardening the roller portion while arranged on the rotary shaft.--

Claim 21 was amended as follows:

--21. (Twice amended) The paper feed roller-producing method set forth in claim 18, wherein a plurality of cylindrical press molded bodies are formed by molding the hydraulic composition and releasing the press molded bodies, connecting the cylindrical press molded bodies together, and the connected press molded bodies are cured and hardened, and the cylindrical roller portion is thereby formed.—

Claim 22 was amended as follows:

--22. (Twice amended) The paper feed roller-producing

method set forth in claim 19, wherein at least one set of adjacent said cylindrical green press molded bodies are connected by a connecting core rod.--